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AUTHOR	Kleen, Betty A.; Shell, L. Wayne; Wells-Roger, Craig A.
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ABSTRACT

The researchers investigated the intensity of computer lab use by a broad representation of students at their university. The purpose was to ascertain adequacy of computer laboratory hardware, software, and hours of access. Additionally, the researchers needed to answer a social policy question, and wished to determine who was making most use of the labs--students who already owned personal computers, or those who did not. Results suggest some inadequacy of number of computers and of operating hours. The results also suggest that owners and non-owners used the labs with equal intensity. Nicholls State University (Louisiana) has used this research in improving instructional technology on campus. (Author/AEF)

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PLANNING FOR ACADEMIC COMPUTING LABORATORIES: HAVES, HAVE NOTS, AND STUDENT USES OF INFORMATION TECHNOLOGY

Betty A. Kleen
Nicholls State University

L. Wayne Shell
Nicholls State University

Craig A. Wells-Roger
Nicholls State University

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The researchers investigated the intensity of computer lab use by a broad representation of students at their university. The purpose was to ascertain adequacy of computer laboratory hardware, software, and hours of access. Additionally, the researchers needed to answer a social policy question, and wished to determine who was making most use of the labs—students who already owned personal computers, or those who did not. The results suggest some inadequacy of number of computers and of operating hours. The results also suggest that owners and non-owners used the labs with equal intensity. The University has used this research in improving instructional technology on campus.

INTRODUCTION

Information technology has become a permanent and essential component of the college experience. More and more college students and faculty have regular instructional experience with information technology-based learning activities. No longer are classroom computing experiences new or experimental. They are demanded instead. Employers demand not just literacy, but computer workplace competence. Universities must include academic computing issues in their strategic planning. Labs and classrooms must provide platforms, software, and access to support the students' experiences. Faculty and academic computing administrators are driven to seek effective solutions in this world of rapidly changing technology.

These changes do not come without cost. Hardware becomes obsolete all too soon. Some technology experiments fail. User support has not kept up with demand. In this volatile environment, academic computing has to address several difficult issues. Three that will be addressed here include:

- Hardware concerns: Are there enough machines on appropriate platforms to meet student needs?
- Software concerns: Do the labs offer appropriate software and training in its use to meet student needs?
- Access concerns: Are there sufficient operating hours to satisfy student demands?

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In addition, there is a social concern. Does the increasing proportion of students with home computers reduce or increase the demands placed on the lab facilities?

These issues will be translated into the investigative questions which will be answered by analysis of survey data.

BACKGROUND

This paper describes one facet of a university's long-range planning for academic computing facilities (primarily student-oriented laboratories). This planning required the collection of data to identify student needs so that the laboratories would best meet those needs.

At the time the research was conducted (November 1995), there was no dial-in access to campus networks other than to the VAX minicomputer. There was then virtually no student use of the World Wide Web. There were 13 computer labs on campus at the time, not all equally, or at all, networked. While some of these labs were unrestricted and during their operating hours open to all students, other labs were restricted to certain groups of students or used for classroom instruction. Student e-mail accounts were not universal but were granted upon student request and upon instructor request.

The university is primarily a commuter school, with only 20% of students living on campus. Students commute primarily from seven surrounding parishes (counties). As at many other universities, many students also have part- or full-time employment.

Based upon anecdotal evidence, student concerns at that time included lack of access to labs when students needed them (nights and weekends), not enough computers with the right software on them, demand for high quality electronic mail, and lack of Internet access. The current research was specifically planned to address the issue of computer lab access.

METHODOLOGY

The primary methodology was case, in the sense that data were captured on a single campus. The methodology was survey, in that a survey instrument was designed to solicit the responses of students at that university. Data were captured by batch administration of the survey instrument in classrooms. This survey was completed in November 1995. The instrument was distributed to all students in all classes previously identified as "using computers as a significant component of the class." The range of identified classes was quite broad, including all English composition courses, all mass communication courses, all computer science courses, all engineering technology, all computer information systems courses, selected courses in management, quantitative business analysis, and other disciplines.

SPSS software was used to generate descriptive statistics, cross tabs and Chi-square analyses.

LITERATURE REVIEW

The researchers summarized the literature into four major themes: the need for long-range, strategic planning for academic computing, the issue of university supplied individual computers versus computer labs, the issue of what predicts intensity of student use, and the monetary and social costs associated with rapid technological change—misjudging the "speed of the train."

Heinrich and Williams (1994) wrote on the importance of long-range planning in constructing computer labs. They noted that "labs have to be able to execute what we need from them." They saw "... a strong need to maintain a focus on the broader, long-term goals of our laboratory environment and not to get distracted by shorter-term, less significant technological changes." Cartwright (1996 a) spoke about the campus wide-area network as the unifying factor in comprehensive information technology (IT) planning. Guskin (1996), on a topic related to planning, noted, "Faculty and administration must lead efforts to change before they become subject to pressure to change from external forces."

Academic computing laboratories have stiff competition in their bid for IT resources. The literature contains many stories about universities where PC ownership by students is required. Monaghan (1994) reported on the University of Washington initiative which gave portable computers to selected freshmen. Other students remained envious of those students with

portable computers even though everyone had access to the University's computer labs. University officials were concerned that the initiative did not create equal access.

DeLoughry (1995) wrote that even at schools where students are required to own personal computers, high quality laboratories are still in demand. DeLoughry further observed that the have, have-not issue is an element in the decision of some schools to require that their students own or, more specifically, have 24-hour access to personal computers. According to those schools administrators, such a requirement serves to level the playing field between more affluent and less affluent students. The researchers believe that this only levels the playing field within a school, not among schools.

Berry and Jones (1995) have conducted research matching one theme of the current paper, that related to intensity of personal computer use by students. Student ownership of personal computers was significant in all five areas of their analysis, such as using a PC for pleasure more often, connecting to systems beyond their own more often, and using productivity packages more often. They found that student PC owners also relied less on classroom instruction to learn about new sources of information technology than those who did not own a PC. Kate (1990) found that 40% of college students said that computers were essential to their lifestyle. Kate found regional differences in PC use with southerners using computers the least.

Need for PC use may be influenced by how prepared students are for college. Cartwright (1996, c, b) says that computer lab planning needs to consider the needs of under-prepared students. A large fraction of college students nationwide need remediation in English and math. Cartwright writes that much of this remediation can take place in computer labs if they have multimedia and CD-ROM technologies.

Hancock (1995) noted social and economic inequities in high schoolers' computer use, that computer availability was not equal by social class, and that the pace of technological change makes closing the access gap nearly impossible. Wilson (1995) discussed the issues of how many computers are needed to serve a student population and issues such as 24-hour access to computer labs. He noted that administrators at various institutions have reported demand for access to computers and networks has doubled, tripled, and even quadrupled within a year's time. Wilson, quoted Green, "Nearly everyone misjudged the speed of the train."

FINDINGS

Both descriptive statistics and some Chi-square testing were used to analyze the data. Following presentation of descriptive information, specific investigative questions are addressed.

Descriptive Findings

There were 697 survey respondents. When identified by student classification, 15.2% were freshmen, 18.9% sophomores, 19.8% juniors, 38.6% seniors, and 7.5% graduate students. When identified by college, 17.6% were in the academic college of arts and sciences, 37.6% in business administration, 6.3% in education, 36.7% in life sciences and technology, and 1.7% other. Over four-fifths (80.3%) of respondents were seeking a four-year degree. Others were seeking graduate degrees, associate degrees, or no degree at all. Sixty different degree programs—almost all offered by the University--were represented in the data.

Slightly over one half (50.1%) of all respondents indicated that they had a home computer they could use for class work; 49.2% percent indicated they did not have such a computer; .7% did not answer the question.

Of the software tools used by respondents, word processing was the most frequently reported (83%). Second most commonly used was spreadsheet software, followed by electronic mail, database managers, and presentation graphics. (In fall of 1995, Netscape access was not available, and accounts for Gopher and e-mail access were limited.) Specifics are shown in the list below.

- Word processing, 83%
- Spreadsheets, 32%
- Electronic mail, 29%
- Database managers, 25%
- Presentation graphics, 19%

- Statistical analysis, 15%
- Gopher/lynx/Netscape, 13%
- All others identified by less than 5%; many under 1%

These usage rates track very well with employer rankings of demanded software skills as reported by Davis (1997).

Investigative Questions

Five investigative questions are answered by a combination of traditional hypothesis tests and descriptive statistics. The findings below relate to differences among various sub-populations (student class, student college, and personal computer ownership) of users of the university computing labs compared to their usage patterns and demands for greater services. These data do not address the quality of work done with the lab computers or the productivity of students using these computers.

The researchers designed the experiment to measure the laboratory usage (how much, what variety, and at what hours) by students in different colleges and classifications. The researchers' interest is whether these usage rates are (1) independent of personal computer ownership, or (2) dependent on personal computer ownership. For this level of testing, the Chi-square test of independence is appropriate. The researchers used alpha = 0.10 as the threshold of significance.

The following hypotheses illustrate this example.

Ho: Student use of labs is independent of personal computer ownership.

Ha: Student use of labs is dependent on personal computer ownership.

The Chi-square test of independence will not reveal whether personal computer ownership results in more or less usage of the labs. Chi-square only shows dependence of the two variables, not direction or causation. In order to test specific relationships within the Chi-square table, a standard test of equality of proportions (or means) will be used, in conjunction with the concept of minimum significant difference.

1. *Do students with home computers utilize a wider variety of campus software applications than non-owners?*

   Personal computer owners reported using an average of 2.47 applications in the university labs. Non-owners reported using 2.66 applications, only nominally larger. This difference is significant at .05. Non-owners use more applications than owners.

2. *Do students who own or have access to a home computer use the campus labs more hours than non-owners?*

   Usage hours were not significantly different between personal computer owners and non-owners. Specifically, personal computer owners did not use the lab more hours than non-owners. This is evidence that the university-provided lab is reaching its intended audience, and not exacerbating a technological "have" versus "have-not" issue.

3. *Do students in certain colleges make more use of the campus labs than students in other colleges, as measured by lab hours per week, and by number of applications used?*

   There was substantial variation in number of applications used by students in different colleges. Business students reported using 3.61 applications, arts and sciences 2.78, and life sciences and technology, 1.78. College of education students used the fewest applications, 1.64. Business students' use was more than double that of education students. The minimum significant difference is .139. All four college means depart significantly from the university mean; all four college means differ significantly from one another.

   There was a smaller difference regarding hours of lab use by students in different academic colleges. Arts and sciences was first (4.77 hours); education was last (3.31 hours). The extreme values were relatively closer together than when considering number of applications used. The minimum significant difference in this case is 0.193 hours. Only the business administration mean is not significantly different from the university mean. Each college mean is significantly different from all other colleges.

4. *Do students in different colleges and classifications experience bottlenecks at certain times?* The students were asked to indicate times "you needed access to a computer lab for academic work and access was either not available or you had to wait more than 15 minutes for a computer."

   The issue of hours of access is reported descriptively, not by hypothesis testing. Approximately one third (31.4%) of all respondents identified 8 a.m. to noon as a lab resource bottleneck. The afternoon time slot, noon to 4:30 p.m., was reported a bottleneck by 26.5% of respondents. Early evening, 4:30 - 8:30, was a bottleneck for 22.8% of respondents. This time period was labeled a bottleneck by only 7.5% of freshmen, but by more than one-fourth of juniors, seniors, and graduate students. Late evening, 8:30 - midnight, was identified by 18.2% of respondents as a bottleneck time (many of the campus labs were not open after 8:30 p.m., rendering access unavailable). Graduate students showed the highest percentage of need at 26.9%. In the midnight to 8 a.m. time span, only 8.3% indicated need. Since all labs were closed, this implied they had no access, not that they had to wait for a computer.

   During the morning period, business students were more apt to indicate access difficulties than students in any other college (41.6%). Computer owners reported they had access problems in the morning 28.4% of time; non-owners 34.7%. Non-owners had greater problems. This pattern is repeated in the afternoon; owners reported difficulties 19.8%; non-owners, 33.5%.

5. *Are students who have home computers more willing to pay lab fees for 24-hour access than personal computer non-owners?*

   The researchers tested for the dependence of the variable how much students would be willing to pay for 24-hour lab access on the variable computer ownership. There were three hypothetical forms of 24-hour lab access offered on the questionnaire.

   - 24-hour access for a few weeks during a semester
   - 24-hour access during the semester
   - 24-hour access year round

   Only the first of these showed a significant relationship (.06085). The responses for that case are shown in Table 1 below.

TABLE 1

PC OWNERS' AND NON-OWNERS' WILLINGNESS TO PAY LAB FEES FOR HOURS OF LAB AVAILABILITY

PC Ownership	Pay $0	Pay $1 - $5	Pay $6 - $10	Pay $11 - $15	Pay $16 - 20
Have PC	88	98	58	3	11
No PC	84	112	42	15	8

While the two variables were statistically dependent, the average amount of money offered by the personal computer owners and by the non owners was the same at $3.53. Do personal computers demand more 24-hour access than the non-owners? The answer to that is "no." Neither do personal computer owners demand less 24-hour access to labs than non-owners.

SUMMARY AND CONCLUSIONS

This research reached all students enrolled in classes "using computers as a significant part of the class." This group of 697 respondents appears to be broadly representative of university enrollment. These respondents ranked their use of software tools in virtually the same order as employers rank importance of software skills. Personal computer owners and non-owners place equal demands on university lab facilities, as measured by hours of use. Personal computer owners used fewer applications in the labs than non-owners, by a small but significant amount. Students in different colleges made substantially different demands on the labs, by applications as well as by hours used. This research did not address issues of quality of student work or student productivity in the labs.

About one-fourth of all students reported delays in access or lack of access to computer labs. Access problems were most frequent in the morning hours (8:30 - noon). Access problems declined rather smoothly throughout the day. Such declines may be natural for a commuter campus, but residential status of students was not collected. For the most part, personal

computer owners and non-owners have similar opinions regarding lab fees for 24-hour access to the labs.

When one-fourth of the respondents needed access but had to wait, or found no open lab, there is serious question as to the adequacy of the number of personal computers and of operating hours of the labs. The researchers' original concern was that labs might not be serving their purpose of providing access to all students, especially those with none at home, but were being used more by personal computer owners, enlarging the computer literacy rift. The data do not support any such "perverse" use of the labs. Personal computer owners and non-owners used the labs at about the same intensity, suggesting that the lab policies were having their intended effect.

POSTSCRIPT

Since these data were gathered and analyzed, the University has continued its student-oriented push for more and better instructional technology. The University has just this semester levied a new technology fee, with student support, and has plans for making the largest unrestricted lab (in the University library) a 24-hour operation.

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